

## REMARKS

This Amendment is responsive to the Office Action dated November 1, 2005. Applicant has amended claims 7, 22 and 37, and added new claims 46-57. Claims 1-57 are pending.

### Claim Rejection Under 35 U.S.C. § 101

In the Office Action, the Examiner rejected claims 1-45 under 35 U.S.C. 101 as being directed to non-statutory subject matter. Applicant respectfully traverses this rejection.

Applicant's claims define statutory subject matter for purposes of 35 U.S.C. 101.

In support of the rejection, the Examiner advanced two bases for the conclusion that claims 1-45 do not define statutory subject matter. First, the Examiner stated that claims 1-30 are not claimed to be practiced on a computer. On this basis, the Examiner stated that the claims are not limited to practice in the technological arts, and are therefore non-statutory. Second, the Examiner stated that none of the claims are limited to practical applications, and instead represent merely abstract ideas. The Examiner further stated that the claims do not specify a useful, concrete and tangible result.

With respect to the technological arts basis, Applicants direct the Examiner to the recent decision by the Board of Patent Appeals and Interferences in *Ex parte Lundgren*, Appeal No. 2003-2088 (Bd. Pat. App. & Inter. 2005). In *Lundgren*, the Board held that section 101 does not impose a technological arts requirement for statutory subject matter eligibility. Therefore, the rejection should be withdrawn to the extent it is based on such a requirement.

With respect to the abstract idea basis, Applicants respectfully submit that the claimed invention clearly provides a useful, concrete and tangible result. The various claims are directed to a method, apparatus, and article of manufacture useful in data classification. Although the claimed invention may rely in part on mathematical relationships and computing techniques, it presents a substantial practical application of such relationships and techniques to data classification.

It seems undeniable that such subject matter provides a useful result, i.e., identification of different classes of data within a larger set of data. Data classification may be used in a wide variety of fields including, for example, data mining, medical diagnosis, medical prognosis, fraud detection, intrusion detection, credit evaluation and gene expression.

The result provided by the claimed invention is also concrete within the meaning of section 101. In particular, the data classification results are concrete in the sense they provide a repeatable, predictable result in classifying data into different classes. Accordingly, there should be no question that the claimed invention provides a concrete result.

Finally, the claimed invention also provides a tangible result. Neither section 101 nor the case law require that, to be tangible, a claim be tied to a particular machine or apparatus or operate to change articles or materials to a different state or thing. On the contrary, the result must be tangible in the sense that the claimed invention provides a practical application.

The claimed invention does not simply manipulate abstract ideas. The fact that the claims recite the use of a linear programming formulation does not mean that the claims merely define an abstract idea. On the contrary, the linear programming formulation is one aspect of the claimed invention as a whole, which applies the linear programming formulation to produce a reduced input set for use by a support vector machine classifier in classifying data.

In particular, the claims require selection of an input set for a support vector machine classifier based on a solution to an exterior penalty function of a dual of a linear programming formulation of the support vector machine classifier. The selection of an input set for a support vector machine classifier is not an abstract idea per se, nor merely a mathematical algorithm in the abstract.

As described in Applicant's disclosure, a support vector machine (SVM) classifier is a tool for data classification and is often used for data mining operations. To enhance performance of an SVM classifier, it is desirable to make the input set used to define the separating surface applied by the SVM classifier as small as possible. The input set for an SVM classifier may present thousands, or even millions, of data points. The claimed invention permits suppression of the input set to substantially enhance the performance of an SVM classifier.

Hence, identification of the particular type of data classified by the SVM classifier is not necessary to support a practical application. Rather, the practical application of the claimed invention is data classification itself. This is similar to an invention relating to data encryption, encoding or compression. In those cases, mathematical expressions are applied to encrypt, encode or compress data, without necessary regard to the particular nature of the data.

The practical application of the claimed invention is data classification, much like the practical application of a data encryption process is encryption, without regard to the type of data that is encrypted. On a similar note, the practical application of a fluid handling device is fluid handling, regardless of the particular type of fluid that is handled. To view the practical application in terms of the type of data that is classified misses this point.

Applicant respectfully submits that the Office Action seems to place too much emphasis on the presence of a linear programming formulation in the claims, and overlooks the application of the linear programming formulation in reducing the input set for a support vector machine classifier to enhance data classification performance. Upon realization that the claimed invention is not directed to an abstract idea per se, but rather a practical application of mathematical relationships to perform data classification, it should be clear that the claimed invention defines statutory subject matter under section 101.

Notably, the Examiner has identified a number of U.S. patents with claims relating to data classification. Two examples are U.S. Patent Nos. 6,112,195 and 6,134,344, both to Burges, which include claims relating to the use of data classifiers such as support vector machines. Claim 1 of the '195 patent, for example, recites incorporating a local invariance in such a way that a resulting dimension of each feature vector in a kernel-based classifier system (e.g., a support vector machine) is fixed and that the dimension is equal to the dimension of input data minus the number of degrees of freedom in the local invariance, wherein the input data is of dimension  $N$  and the provided data is of dimension  $M$ , where  $M > N$ . The invention claimed in the '195 patent to Burges certainly makes use of mathematical relationships. Like the invention claimed by Applicant, however, the Burges invention is directed to the practical application of such relationships to a data classifier.

In view of the remarks above, Applicant respectfully requests withdrawal of the rejection under section 101.

In addition, Applicant notes that new claims 46-54 recite additional features of the claimed invention. For example, new claims 46, 49, and 52 specify use of the claimed invention by application of a support vector machine classifier to classify data relating to fraud detection, credit evaluation, gene expression, intrusion detection, medical diagnosis or medical prognosis. In addition, claims 47, 48, 50, 51, 53 and 54 specify use of the claimed invention by application

of a support vector machine classifier to classify data relating to multiple myeloma. Multiple myeloma is often fatal. Accordingly, accurate classification of data relating to multiple myeloma is important for diagnosis and treatment of patients suffering from the disease.

New claims 55-57 define a support vector machine classification system comprising a data storage medium storing input data for classification, a support vector machine classifier, and a selection module. The support vector machine classifier classifies the input data into a first set of data and a second set of data based on a set of input features. The selection module produces a reduced set of input features for the support vector machine classifier based on a minimization of an exterior penalty function of a dual of a linear programming formulation of the linear support vector machine classifier for a finite value of a penalty parameter. Clearly, the support vector machine classification system of claims 55-57 is used for a practical application that provides a useful, concrete and tangible result.

**Claim Rejection Under 35 U.S.C. § 112**

In the Office Action, the Examiner rejected claims 1-45 under 35 U.S.C. 112, first paragraph. The Examiner indicate that such a rejection is required in view of the section 101 rejection. Without addressing this contention in detail, Applicant respectfully submit that the claimed invention satisfies the subject matter eligibility requirements of section 101, for the reasons expressed above. Therefore, it follows that the rejection under 35 U.S.C. 112, first paragraph, should be withdrawn, as the disclosure clearly is sufficient to enable one skilled in the art to make and use the invention for a practical application, e.g., data classification, without undue experimentation.

**Claim Rejection Under 35 U.S.C. § 102**

In the Office Action, the Examiner rejected claims 1-45 under 35 U.S.C. 102(b) as being anticipated by "Finite Newton Method for Lagrangian Support Vector Machine Classification" by Fung et al., Data Mining Institute Report, 02-01, February 2002 (Fung). Applicant respectfully traverses the rejection. Fung fails to disclose the claimed invention, as required by 35 U.S.C. 102(b), and provides no teaching that would have suggested the desirability of modification to include such features.

For example, Fung does not disclose or suggest defining a linear programming formulation of a support vector machine classifier, solving an exterior penalty function of a dual of the linear programming formulation to produce a solution to the support vector machine classifier, and selecting an input set for the support vector machine classifier based on the solution, as set forth in claims 1-15. Fung also does not suggest a computer-readable medium storing instructions to cause a processor to perform such functions, as set forth in claims 31-45.

In addition, Fung lacks any teaching that would have suggested a classification system comprising a processor that applies a linear programming formulation of a support vector machine classifier to classify data based on an input set, and an input module that generates the input set based on a solution of an exterior penalty function of a dual of the linear programming formulation, as defined by claims 16-30.

More particularly, it is clear that Fung does not disclose the use of a linear programming formulation of a support vector machine classifier. On the contrary, as described by Applicant at paragraph [0028] of the disclosure, Fung describes a quadratic programming formulation of a support vector machine. A quadratic programming formulation is nonlinear. A quadratic programming formulation, unlike a linear programming formulation as claimed, does not generate sparse solutions and hence does not suppress input features. This characteristic of a nonlinear, quadratic programming formulation contrasts with the strong feature suppression property possible with a linear programming formulation as claimed.

In support of the rejection, the Examiner pointed to page, 3, paragraph 2, line 9, of Fung, and suggested that this passage discusses defining a linear programming formulation of a support vector machine classifier. However, in this passage, Fung describes the use of a quadratic programming formulation of a support vector machine classifier. The quadratic programming formulation may be applied to a linear or nonlinear support vector machine classifier. In the Fung reference, however, the programming formulation itself is quadratic, i.e., nonlinear. With this clarification, it should be clear that Fung does not disclose or suggest the requirements of the claimed invention.

In view of the fundamental differences identified above, Fung does not disclose or suggest the invention defined by Applicant's claims. Applicant respectfully requests withdrawal of the rejection under section 102 in view of Fung. Applicant does not admit or acquiesce in the

propriety of the Examiner's characterization of the Fung reference relative to the requirements of the dependent claims. In light of the differences between Fung and the inventions defined by the independent claims, however, it is not necessary at this time to discuss the further differences presented by the dependent claims.

**New Claims:**

Applicant has added new claims 46-57 to the pending application. New claims 46, 49, and 52 specify use of the claimed invention by application of a support vector machine classifier to classify data relating to fraud detection, credit evaluation, gene expression, intrusion detection, medical diagnosis or medical prognosis. Claims 47, 48, 50, 51, 53 and 54 specify use of the claimed invention by application of a support vector machine classifier to classify data relating to multiple myeloma.

New claims 55-57 define a support vector machine classification system comprising a data storage medium storing input data for classification, a support vector machine classifier, and a selection module. The support vector machine classifier classifies the input data into a first set of data and a second set of data based on a set of input features. The selection module produces a reduced set of input features for the support vector machine classifier based on a minimization of an exterior penalty function of a dual of a linear programming formulation of the linear support vector machine classifier for a finite value of a penalty parameter.

The Fung reference fails to disclose or suggest the inventions defined by Applicant's new claims, and provide no teaching that would have suggested the desirability of modification to arrive at the claimed inventions. No new matter has been added by the new claims.

### CONCLUSION

All claims in this application are in condition for allowance. Applicant respectfully requests reconsideration and prompt allowance of all pending claims. Please charge any additional fees or credit any overpayment to deposit account number 50-1778. The Examiner is invited to telephone the below-signed attorney to discuss this application.

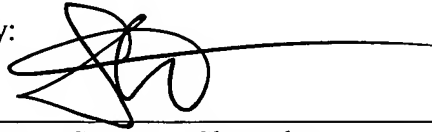
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